Attachment A. Letter from West Coast Fishery Policy Representatives to Dr. William Hogarth, National Marine Fisheries Service

November 15, 2002

Dr. William T. Hogarth
Assistant Administrator for Fisheries
National Marine Fisheries Service
1335 East-West Highway
Silver Spring, MD 20910

Dear Bill,

At the September Council meeting in Portland, Oregon you announced that the existing MRFSS methodology would soon be phased out. Subsequent to that meeting, there has been some uncertainty about what the collective West Coast interests preferred in terms of how to proceed in a new direction. As a result, on October 29, at the Pacific Fishery Management Council meeting in Foster City, California, policy level representatives from the Council, Commission, West Coast States, and the National Marine Fisheries Service (NMFS) Northwest Region discussed implementation of an improved methodology for the collection of West Coast recreational fishery catch statistics.

Because there is no confidence in the estimates of groundfish recreational catch being produced under the MRFSS methodology, we would like to take this opportunity to clearly state our unanimous position as a west coast group, and ask that you direct your staff to implement the following recommendations as a confirmed policy decision:

1) A new West Coast Recreational Data Program (WCRDP) must be developed to respond to Pacific Fishery Management Council data collection priorities and management needs, especially for overfished groundfish stocks.

2) A West Coast Recreational Steering Committee (WCRSC) of State, Commission, Council, and Regional NMFS policy representatives is needed to transition current state and federal recreational data collection activities to the new West Coast Recreational Data Program (WCRDP) The current RecFIN Committee would serve as a technical advisory group to the Steering Committee. The Steering Committee would determine the actual data collection program(s) and that would be reflected in the RecFIN grant proposal.

3) The goal would be to fully implement the new WCRDP by July 1, 2003.

There was also discussion of certain details of the new program that does not use the low-confidence household random dialing MRFSS approach. The new program would be designed to meet the highest priority state and federal needs. Federal funds would be more focused on

Magnuson-Stevens Act needs, particularly species in the federally overfished category. State funds would be focused on state needs such that efficiencies could be gained in the coverage of priority goals for both state and federal needs. The state programs would be integrated in ways that would not only lead to better catch estimates of groundfish but would also generate acceptable estimates for other state priority species.

For example, California would expand its current salmon boat program to cover other species in ways similar to the programs of Oregon and Washington. At the same time they would implement a new ocean boat sampling program in the south along with a random shore mode sampling program throughout the state. Washington will use its federal funds to maintain and improve its catch estimates for ocean fisheries utilizing its shore based creel sampling program coupled with random on-board observations. Oregon would 1) expand its ocean boat sampling under the shore-based effort counting system to year round; 2) institute an observer program to document discard and gather additional biological information; and 3) continue to address recreational catch needs for shore species such as lingcod, cabezon, greenling and rockfish species. The new approach can be designed to produce catch estimates with reasonable confidence limits for fish stocks that have been federally designated as overfished.

The transition to a new West Coast Recreational Data Program will require additional funds. We feel a total of $2.2 M in federal funds is necessary to achieve what we envision as an adequate program for the next cycle, together with an additional $300 K in California funding and status quo funding in Washington and Oregon. Currently, about $1.7 million in federal funds is applied to West Coast recreational fisheries through the MRFSS program. This includes the $300,000 associated with the RDD Phone Survey and the $342,000 promised to cover the winter waves shortfall. California is now committing to provide $300,000 in new funds towards the project. This means that an additional $500,000 in federal funds (for a total of $2.2M in federal funds) is needed to implement an adequate recreational sampling program. It is important to note that the new program is predicated on the understanding that no individual state would receive less federal funding for recreational catch monitoring than they are currently receiving from the MRFSS program. Also, we feel that federal funding towards this effort must be fully administered regionally, as opposed to from national headquarters.

We appreciate your commitment in an earlier conference call on this matter to do your best to provide for an additional $500 K to begin the next cycle as described above. On behalf of the West Coast States and their constituents, the Pacific States Marine Fisheries Commission will actively lobby to obtain additional funds for this program in the ongoing and upcoming budget approval processes. However, in the event that full funding for a new program is not obtained, we want to stress that the Steering Committee should meet to design a lesser program that does not rely on the MRFSS household random dialing methodology. We again accentuate that the current MRFSS methodology lacks credibility on the West Coast and must be replaced with something new, even if at the cost of the number of species targeted or the chronological or geographic strata covered.

We are prepared to initiate implementation of the new program as early as January 1, 2003 with expectations that with your final policy concurrence in the near future, full implementation can be achieved by July 1, 2003. NMFS Northwest Region (NWR) has advised that the new programs will need to target on providing groundfish catch estimates with increased accuracy because of the small actual harvest constraints for some species. As an example, the bocaccio OY south of Cape Mendocino is entirely bycatch mortality. The catch of associated species along with at sea observations of bocaccio bycatch will be used to estimate the bocaccio mortality on an in-season basis. Inseason catch estimates that have acceptable precision and accuracy levels are needed within a month after harvest to support management needs. The Steering Group (WCRSC) and the RecFIN Committee can finalize implementation details including catch estimate precision and reporting goals once we hear that you have directed your staff to implement the necessary administrative changes to actuate the new program.

In summary, we ask that you

- confirm the intent of this letter as a policy decision by the NMFS, and
- direct your staff to implement the administrative changes necessary to allow the new program to move forward.

We also want to stress that we very much appreciate the leadership you have shown towards correcting a serious problem in the management of West Coast marine fisheries. Without the initiative you have shown to make things better in the area of recreational catch statistics, we would be looking again at yet another year of lack of public trust in a key basis for our management decision-making. We are in unanimous support of your decisiveness in this matter.

Randy Fisher, Executive Director
Pacific States Marine Fisheries Commission

Donald McIsaac, Executive Director
Pacific Fishery Management Council

Jeffrey Keonings, Director

Washington Department of Fish and Wildlife

Lindsay Ball, Director
Oregon Department of Fish and Wildlife

Robert Hight, Director
California Department of Fish and Game

cc: Bob Lohn, NMFS Northwest Regional Administrator
Rod McInnis, Acting NMFS Southwest Regional Administrator

Attachment B. Ocean Salmon Project Methodology for Estimating Recreational Salmon Landings

OCEAN SALMON PROJECT
METHODOLOGY FOR ESTIMATING
RECREATIONAL SALMON LANDINGS
April 2003

By

Melodie Palmer-Zwahlen and Allen Grover
Ocean Salmon Project
California Department of Fish and Game[1]

INTRODUCTION

This paper was prepared in response to a proposal of the West Coast states to develop their own marine recreational fishery sampling and estimation program. This is because of low confidence in the current methodology used by the Marine Recreational Fishery Statistics Survey (MRFSS) in estimating West Coast marine recreational fishery catches. The new program would be funded using resources provided by the National Marine Fisheries Service (NMFS) in support of the current or an augmented MRFSS program, additional resources provided by the member states, and, possibly, through redirection of existing sampling programs. One such on-going California program is the California Department of Fish and Game's (DFG's) Ocean Salmon Project (OSP), an operation that has provided recreational salmon landings information continuously since 1962. In the following we provide 1) a description of the OSP recreational fishery estimation program, and 2) a discussion of bias and possible estimation errors in the current program.

GOALS AND OBJECTIVES[2]

Goal Statement: To provide information necessary to sustainably manage California's ocean recreational salmon fishery and to meet biological and recovery goals for West Coast salmon populations

Recreation Fishery Sampling Objectives:

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[1] Final document prepared April 1, 2003

[2] The OSP also samples the commercial salmon fishery for average weight data that are used to estimate numbers of fish landed based on pounds landed and reported on DFG fish tickets and to collect CWTs which are reported to the PSMFC; provides technical assistance to inland salmon programs; extract and decode CWTs collected at Central Valley hatcheries and in Central Valley salmon carcass surveys; and participate in technical meetings of the Pacific Fishery Management Council and the Klamath Fishery Management Council.

1) Provide recreation fishery landings estimates by time, area and fishery strata for inseason management and for developing annual salmon fishery management plans.
2) Sample 20% of all recreational fishery salmon landings to provide postseason estimates of the salmon catch by species, angler effort, and the contribution of coded wire tagged (CWT) fish for reporting to the Pacific States Marine Fisheries Commission (PSMFC) by December 15 of each year.
3) Collect other biological and recreational fishery information as necessary to manage the fishery.

DATA STRATIFICATION

Fishery Sectors. The OSP makes separate estimates for Commercial Passenger Fishing Vessels (CPFVs) and private boats (PBs). Past experience has shown that very few salmon are taken from shore. The possible exceptions in some years include Pacifica Pier, Moss Landing jetties, and Humboldt Bay South Jetty.

Port Area Estimates. The OSP has traditionally produced salmon landing estimates for five statistical areas: 1. Crescent City (Oregon border to Big Lagoon), 2. Eureka (Big Lagoon to Horse Mountain near Shelter Cove), 3. Fort Bragg (Horse Mountain to Point Arena), 4. San Francisco (Point Arena to Pigeon Point), and 5. Monterey (Pigeon Point to the U.S.-Mexico border). The estimates normally are for area of landing rather than area of catch; however because of the large statistical areas, relatively few recreationally caught salmon are landed outside of the port areas in which they were caught.

Sampling normally extends from Crescent City Harbor to Avila Beach. In some years when there is a southern shift in the distribution of salmon, sampling may be extended south to include Santa Barbara, Ventura and Oxnard ports.

Temporal Strata. The estimates are generated by half-month period; i.e., 1-15 and 16-end of month. The 2003 salmon season dates, during which salmon sampling will be conducted in the respective areas, are shown in Table 1. The numbers of full-time samplers (by personnel month) that are to be employed to sample the recreational catch by statistical area are shown in Table 2. Primary sampling sites by major port area and fishery are shown in Table 3.

Day Type Strata. PB landing estimates are further stratified by day type including: 1) regular week days and 2) weekend and holiday days. Recognized salmon season holidays include President's Day, Memorial Day, Independence Day, Labor Day, and Columbus Day.

DATA ELEMENTS AND MARKED SALMON SAMPLING

OSP samplers collect the following data from each sampled vessel:

1) Number of anglers (includes CPFV skipper and crew if they retain salmon)
2) Fishing method: troll, mooch, or both
3) Number of salmon landed by species
4) Number of Ad-clipped (marked) salmon by species
5) Number of coho (an endangered species) released
6) Number of sublegal chinook released
7) Number of salmon lost to pinnipeds

In recent years, the samplers have collected the following additional data from salmon and non-salmon PBs:

8) Number of rockfish landed
9) Number of halibut landed
10) Number of lingcod landed
11) Number of all other species landed
12) Number of anglers in non-salmon boats

Salmon trips are defined as those trips in which salmon was the target species for all or part of the day. A combination trip, on which several species including salmon may be targeted, is considered a salmon trip

All Ad-clipped salmon recovered in the sampling are measured in the field for fork length (to the nearest mm) and their heads removed for later CWT extraction and decoding in the lab.

COMMERCIAL PASSENGER FISHING VESSEL (CPFV) ESTIMATION PROGRAM

A two-stage program is used to estimate effort and landings by CPFVs. Total effort is determined by counting the actual number of CPFVs that targeted salmon each day of the season by port and area. Local employees (mostly field samplers**)** visit the landing areas or make phone calls to get these counts, which are usually made on the same day the fishing trip was conducted. Post season, OSP staff compare the counts to the submitted logbooks (which are required by law) and may adjust the counts upwards if more logs are returned for a given port-day than the number of boats counted during the season. The OSP does not depend on log returns to estimate total salmon fishing effort (or catch) because of the highly variable return rate of these documents by individual skippers (average return rate has been about 75% in recent years, which is up from an average return rate of about 54% in the mid 1990s). However, there has been close agreement over the years between the salmon landings and angler effort observed by samplers in the field and the salmon landings and angler effort reported on submitted logs.

Sampling of completed CPFV salmon trips is conducted to estimate the various items (elements) of interest, explained above, and to recover marked salmon. Samplers are deployed to the major landing areas (see Table 1) with the intent of sampling 20% of the CPFV landings in each statistical area during each half-month time period. The number of landings made in each statistical area is used to gauge the number of boats to sample to achieve the 20% sampling objective. Note: The OSP only samples completed trips

dockside and does not use at-sea sampling to estimate the total salmon catch, including released fish.

The sample-based estimator for individual items (Y) in the CPFV fishery is:

$$(1) \qquad \hat{Y}_{ij} = N_{ij} \frac{\sum_k y_{ijk}}{n_{ij}},$$

where:

$\hat{Y}_{ij}$ = estimated total number of items in area *i*, time period *j*.
N_{ij} = total number of CPFV salmon trips taken in area *i*, time period *j*.
y_{ijk} = number of items sampled in area *i*, time period *j*, CPFV trip *k*.
n_{ij} = number of CPFVs sampled in area *i*, time period *j*.

Assuming the sampling of CPFV trips is at random without replacement in area i, time period j, the sampling variance of $\hat{Y}_{ij}$ is estimated as

$$(2) \qquad \hat{V}\left(\hat{Y}_{ij}\right) = N_{ij}^2 \left(1 - f_{ij}\right) \frac{s_{ij}^2}{n_{ij}},$$

with $f_{ij} = n_{ij} / N_{ij}$, the sampling fraction, and

$$s_{ij}^2 = \frac{1}{n_{ij} - 1} \left[\sum_k y_{ijk}^2 - \frac{1}{n_{ij}} \left(\sum_k y_{ijk} \right)^2 \right].$$

The estimated totals and variances are additive across strata so that, for example,

$$(3) \qquad \hat{Y} = \sum_i \sum_j \hat{Y}_{ij}, \quad \text{and} \quad \hat{V}\left(\hat{Y}\right) = \sum_i \sum_j \hat{V}\left(\hat{Y}_{ij}\right).$$

PRIVATE BOAT FISHERY ESTIMATION PROGRAM

The OSP uses stratified random sampling to estimate salmon fishing effort and landings by private and rental boats (collectively referred to as private boats, PBs). The basic sampling unit is a sample area-day. The sample areas, grouped by statistical area, are shown in Table 1. One or two samplers are responsible for determining 100% of the salmon fishing effort and catch made on each sample area-day. Sample area-days are drawn at random, without replacement, prior to each month in each area.

In some areas, the samplers are not able to contact and sample all returning PBs. In these instances, a count is made of missed PBs either as they pass by the sampler's vantage point or based on the number of empty boat trailers in parking areas at the end of the day. When making these counts, the sampler makes a judgment whether the missed boat was a fishing boat such as the presence of fishing gear on the observed boat or the type of boat trailer type. Sail boats or sail boat trailers, for example, generally are not counted as missed fishing boats. On these occasions, the number of items for that particular sampled area-day is estimated as:

$$(4) \qquad \hat{y}_{ijkl} = T_{ijkl} \frac{z_{ijkl}}{t_{ijkl}},$$

where:

$\hat{y}_{ijkl}$ = estimated total number of items in area *i*, time period *j*, day-type *k*, day *l*.

z_{ijkl} = number of items sampled in area *i*, time period *j*, day-type *k*, day *l*.

t_{ijkl} = number of boat-trips sampled in area *i*, time period *j*, day-type *k*, day *l*.

T_{ijkl} = total number of boat-trips in area *i*, time period *j*, day-type *k*, day *l*.

Several boat landing areas are not sampled by the OSP because of previous experience showing that very few salmon are landed at these areas. These areas are believed to account for less than 5% of the total skiff salmon effort and catch.

The sample-based estimator for individual items (Y) in the PB fishery is:

$$(5) \qquad \hat{Y}_{ijk} = N_{ijk} \frac{\sum_{l} \hat{y}_{ijkl}}{n_{ijk}},$$

where:

$\hat{Y}_{ijk}$ = estimated total number of items in area *i*, time period *j*, day-type *k*.

N_{ijk} = total number of calendar days in area *i*, time period *j*, day-type *k*.

$\hat{y}_{ijkl}$ = (estimated) number of items in area *i*, time period *j*, day-type *k*, day *l*.

n_{ijk} = number of calendar days sampled in area *i*, time period *j*, day-type *k*.

Ignoring the variance introduced through estimation of y_{ijkl} by $\hat{y}_{ijkl}$ (typically $\hat{y}_{ijkl}$ within 10% of z_{ijkl}), the variance of $\hat{Y}_{ijk}$ is estimated as

$$(6) \qquad \hat{V}\left(\hat{Y}_{ijk}\right) = N_{ijk}^2 \left(1 - f_{ijk}\right) \frac{s_{ijk}^2}{n_{ijk}},$$

with $f_{ijk} = n_{ijk} / N_{ijk}$, the sampling fraction, and

$$s_{ijk}^2 = \frac{1}{n_{ijk} - 1}\left[\sum_l \hat{y}_{ijkl}^2 - \frac{1}{n_{ijk}}\left(\sum_l \hat{y}_{ijkl}\right)^2\right].$$

Again, the estimated totals and variances are additive across strata so that, for example,

(7) $$\hat{Y} = \sum_i \sum_j \sum_k \hat{Y}_{ijk}, \quad \text{and} \quad \hat{V}\left(\hat{Y}\right) = \sum_i \sum_j \sum_k \hat{V}\left(\hat{Y}_{ijk}\right).$$

DATA BASE OUTPUTS

The OSP provides current year recreational salmon data to the Regional Mark Informational System of the PSMFC by December 15 of each year. These data include estimates of recreational salmon landings by species, CWT group, statistical area, and half-month time period. They also input the species estimates to the Pacific Fishery Management Council (PFMC) for use by the Salmon Technical Team (STT) in producing the PFMC's Annual Review of West Coast Ocean Salmon Fisheries. CWT estimates from the Klamath basin are forwarded to the Klamath River Technical Advisory Team for use in the Klamath Ocean Harvest Model, a tool for analyzing fishing impacts of proposed ocean salmon fishing regulations for the ensuing season.

DISCUSSION: BIAS AND POTENTIAL SOURCES OF ERRORS

The OSP has not computed confidence intervals for its estimates in recent years. Typically, the 95% interval for total season catch recreational landings is + or – 10% of the estimate itself. This narrow range can be attributed to large sample size. By counting all CPFVs each day of the season, the OSP eliminates the need to estimate total CPFV effort. Post-season analysis is done to verify or correct the OSP in-season counts. The OSP has learned that they cannot depend on logbook returns to estimate total CPFV effort or catch as many skippers fail (or refuse) to complete and submit their logs.

The OSP is able to move quickly through the boats, both CPFV and PB, on each sample day in part because they limit the number of questions that anglers are asked. They also do not collect data specific for an individual angler. Collection of CWT heads and biological data is the most time consuming part of the overall OSP field sampling program.

The program has been in place since 1962 and the staff has learned how to make optimal use of their limited resources. The fact the OSP does not sample some areas where salmon may occasionally be landed is not believed to be an important source of underestimation of landed catch. However, no study has been conducted and reported to document the relative importance of these unsampled areas to the total salmon catch.

Another program strength is that the field samplers attempt to sample all landings at an assigned facility on sample days. This reduces the potential for bias associated with time of day landings are made. However, the assumption that the catch and effort by unsampled boats on a port-day are the same as sampled boats has not been verified. Unsampled boats are quite often boats moored at a private facility or that continue to fish after the sampler has gone home. It is questionable whether these missed anglers have the same motivation in fishing for salmon (or any other species) as those that take their boat in and out of the water on the same day.

Weather conditions are the single greatest source of variation in the PB data. Salmon catches can be relatively high in an area then fall off to zero or very low levels with the onset of inclement fishing conditions. The OSP has not attempted to do post-season stratification of the data to isolated "bad" and "good" weather samples (however that would be defined). It is possible that published weather statistics (e.g., swell height or wind speed) could be used to do post-season weather stratification, but we can't be certain the resulting analysis would, in most cases, increase the precision of the estimates due to the increased stratification. There would also be the problem during some periods of the lack of samples for both weather strata.

Asking PB anglers for information on released or lost catch may be biased as it depends on the ability of anglers to accurately recall all the salmon encounters during the day and to differentiate the different salmon species in the released catch. Some fishermen may use the opportunity to complain about pinniped (primarily sea lion) encounters or fishery regulations that require them to release Chinook salmon below the minimum size and all coho salmon, an endangered species. This could result in exaggerated reporting by some individuals or deflated reporting by individuals wishing to downplay their incidental catches (for fear of more restrictive regulations).

Salmon are, by and large, landed on the same day they are caught; thus the OSP does not have to deal with the issue of sampling multiple-day trips. This is not to say that some fishermen do not on occasion catch and store salmon on their vessels for 2 or more days before landing their fish. Vessels that moor upstream from Rodeo near Carquinez Straight that make multiple day ocean fishing trips are not available to be sampled by OSP staff. Also, salmon are rarely taken at night; thus end-of-day sampling is efficient for examining all of the fish taken on a particular day of the season.

The OSP has begun to collect non-salmon landings data in recent years. This has been a trial program, and the additional sampling has not compromised their salmon sampling objectives. These data have not been analyzed as it is not clear how these data would be meaningful for the management of these other species.

Table 1. Season structure of 2003 ocean salmon recreational fishery (number of days open by port area and month)

Statistical Port Area	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	Total
					Month								
Crescent City					15 d	30 d	31 d	31 d	14 d				121 d
Eureka					15 d	30 d	31 d	31 d	14 d				121 d
Fort Bragg		14 d	31 d	30 d	31 d	30 d	31 d	31 d	30 d	31 d	16 d		275 d
San Francisco				19 d	31 d	30 d	31 d	31 d	30 d	31 d	15 d		218 d
Monterey			3 d	30 d	31 d	30 d	31 d	31 d	30 d				186 d
Total		14 d	34 d	79 d	123 d	150 d	155 d	155 d	118 d	62 d	31 d		921 d

Table 2. Budgeted sampler time by port area and month for 2003 ocean salmon recreational fishery.

Statistical Port Area	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	Total
					Month								
Crescent City					0.8 PM	1.0 PM	1.0 PM	1.0 PM	0.5 PM				4.3 PM
Eureka					1.5 PM	2.0 PM	2.0 PM	2.0 PM	1.0 PM				8.5 PM
Fort Bragg		0.5 PM	1.0 PM	1.0 PM	2.0 PM	2.0 PM	2.0 PM	2.0 PM	1.0 PM	1.0 PM	0.5 PM		13.0 PM
San Francisco				3.0 PM	4.5 PM	4.5 PM	4.5 PM	4.5 PM	4.5 PM	3.0 PM	1.0 PM		29.5 PM
Monterey			0.3 PM	3.0 PM	3.0 PM	3.0 PM	3.0 PM	1.5 PM	1.0 PM				14.8 PM
Total		0.5 PM	1.3 PM	7.0 PM	11.8 PM	12.5 PM	12.5 PM	11.0 PM	8.0 PM	4.0 PM	1.5 PM		70.1 PM

Table 3. Primary OSP sampling sites north of Pt Conception by major port area and fishery, 2003 season.

Major port	Private skiffs	CPFVs	Commercial
Crescent City			
Crescent City launch ramp	X		
Crescent City docks	X	X	X
Eureka			
Trinidad Hoist	X		
Trinidad docks	X	X	X
Eureka	X	X	X
Field's Landing	X		
Fort Bragg			
Shelter Cove	X	X	X
Fort Bragg/Noyo	X	X	X
San Francisco			
Bodega Bay/Westside	X	X	X
Sausalito	X	X	X
Berkeley/Emeryville	X	X	
San Francisco Wharf		X	X
Princeton	X	X	X
Monterey			
Santa Cruz	X	X	X
Moss Landing	X	X	X
Monterey	X	X	X
Morro Bay	X	X	X
Avila Beach	X	X	X
Total # of sites:	17	15	14

Attachment C. Power and Authority to Collect Sport Fish Information in California

Overview

The authority to collect sport fishing information is specified in the Fish and Game Code (FGC) and the California Code of Regulations, Title 14. Natural Resources (CCR, Title 14). There are three levels of authority. First, there are the general regulatory powers delegating the California Fish and Game Commission (Commission) and the California Department of Fish & Game (CDFG) to manage, conserve, and sustain fish and wildlife resources. Examples of these general regulatory powers are found in Division 1. (Fish and Game Commission) and 2.(Department of Fish and Game) of the FGC.

Secondly, there are general conservation, management, and provisions regarding policies for marine living resources and sport fishing. Examples of these policies are found in Division 6. (Fish), Part 1.7. (Conservation and Management of Marine Living Resources), and Part 2.(Sport Fishing) of the FGC.

Third are the specific provisions regulating the taking and possession of fish. Examples of these provisions are found in Division 6. (Fish), Part 2. (Sport Fishing), Chapter 2. (Particular Varieties of Fish) in the FGC; and Division 1. (Fish and Game Commission – Department of Fish and Game), Chapter 4. (Ocean Fishing), and Article 1. (Ocean and San Francisco Bay District) in CCR, Title 14.

General Regulatory Powers

The ultimate power to manage California's fish and wildlife resources belongs to the California Legislature. The legislative branch of government passes laws. The California Legislature has delegated certain powers to the Commission and CDFG.

<u>Commission</u>

The FGC delegates the Commission the power to regulate the taking or possession of fish to the extent and manner prescribed in the FGC. It should be noted "fish" is defined in the FGC as "wild fish, mollusks, crustaceans, invertebrates, amphibians, including and part, spawn or ova thereof" (FGC §45). Another important term defined in the FGC is "take." This term means "hunt, pursue, catch, capture, or kill" (FGC §86).

The Commission has no authority to regulate fish, amphibian, kelp, or other aquatic plants for commercial purposes (FGC §200). This means the commission can regulate sport fishing but cannot regulate commercial fishing unless it is authorized by the California Legislature.

The Commission may regulate sport fishing in any California areas, districts, or portions of the state (FGC §200). The Commission may also regulate species or subspecies as follows in FGC §205:

(a) Establish, extend, shorten, or abolish open seasons and closed seasons.
(b) Establish, change, or abolish bag limits, possession limits, and size limits.
(c) Establish and change areas or territorial limits for their taking.
(d) Prescribe the manner and the means of taking.

California Department of Fish & Game

The CDFG shall expend funds necessary for biological research, field investigations, and for the collection and diffusion of such statistics and information pertaining to the conservation, propagation, protection, and perpetuation of fish (FGC §1000).

Within FGC, Division 2. (Department of Fish and Game) is a policy regarding the conservation of aquatic resources. This policy encourages "the conservation, maintenance, and utilization of the living resources of the ocean and other waters under the jurisdiction and influence of the state for the benefit of all citizens of the state…" (FGC §1700). This policy includes six objectives including (1) the maintenance of sufficient populations of all species of aquatic organisms to insure their continued existence, (2) the maintenance of a sufficient resource to support a reasonable sport use, and (3) management on the basis of adequate scientific information with the objective of maximizing the sustained harvest [FGC §1700 (a)(c)(e)].

General Conservation, Management, and Provisions Regarding Policies for Marine Living Resources and Sport Fishing

The Marine Life Management Act (MLMA) was signed into law in 1998 (FGC §7050 – 7090). The MLMA gives guidance on marine policies, fisheries science, and management of California's marine living resources. It supports and promotes scientific research, and states marine resources should be managed on the best available scientific information. The MLMA states CDFG, "to the extent feasible, will conduct and support research to obtain essential fishery information for all marine fisheries managed by the state" [FGC §7060 (b)]. A major cornerstone of the MLMA is the fishery management plan process. Fishery management plans will "form the primary basis for managing California's sport and commercial marine fisheries" [FGC §7072 (a)]. Two key components in any fishery management plan are (1) "the species of fish and their location, numbers of vessels and participants involved, fishing effort, historical landings in the sport and commercial sectors, and a history of conservation and management measures affecting the fishery," and (2) "economics and social factors related to the fishery" [FGC §7080 (a) and (e)].

Fish and Game Code, Part 2. (Sport Fishing) addresses possession of bag limits and makes it unlawful to sell or purchase sport fish.

Specific Provisions Regulating the Taking and Possession of Fish

Fish and Game Code

The methods of take are listed for spiny lobster (FGC §7256) and take restrictions for giant seabass (FGC §7350) in Part 2 of the FGC.

California Code of Regulations, Title 14

Chapter 4. (Ocean Fishing) and Article 1. (Ocean and San Francisco Bay District) in CCR, Title 14, lists the general take, as well as, seasons, daily bag limits, size limits, management areas, and methods of take (CCR, Title 14, §27.00 through 30.10).

Chapter 6.5. (Fishing Activity Records) describes the fishing activity records a commercial passenger fishing vessel license holder shall keep (CCR, Title 14, §190), and report of fish taken and cooperation with State and federal observers (CCR, Title 14, §195).

Summary

The CDFG must collect sport fish catch information to meet the conservation and management policies for California's marine living resources. The authority to collect this information is specified in the FGC and CCR, Title 14.

Attachment D - Site Stratification for PR Public Access Boats

There are hundreds of public and private access launching and mooring facilities along the California coast and within its harbors and bays that are utilized by PR anglers. PR public access boating facilities differ from private access boating facilities in that the former are reasonably accessible to creel sampling while the latter are not. During 1999-2002, 87 PR public access sites were sampled in California. Broken out by survey area, there were: Crescent City/Eureka Survey Area, 9 sites; Fort Bragg Survey Area, 8 sites; San Francisco Survey Area, 23 sites; Monterey/Morro Bay Survey Area, 10 sites; and Southern California Survey Area, 37 sites. For the purpose of this task, a sample "site" is defined as a public landing facility where most of the fishing effort (anglers/boats) returning to port can be sampled or counted by a creel sampler under most weather conditions. Creel data includes both effort and specific species catch rate information.

During the past 40 years, the OSP has sampled 17-20 sites annually (primarily north of Pt. Conception) to collect recreational ocean salmon catch and effort information. A CRFS development sub-committee determined that expanding the OSP 20% sampling rate for effort, catch and the recovery of coded wire tags to all 87 PR sites would exceed the available funds; thus various alternatives were examined to stratify the site-sample frame. The most successful alternative used the catch of management species to stratify sites.

Site Stratification by Estimated Catch for PR Sites

Catch by site was analyzed to determine which PR public access sites had the highest catch of management species. For the analysis, management species were defined as those with active or proposed fishery management plans (FMPs) and include salmon, groundfish (rockfish, lingcod and certain roundfishes, flatfishes, sharks and rays), highly migratory species (tunas, billfishes, dolphinfish, and certain oceanic sharks); and nearshore species such as California sheephead and California halibut. Catch data for these species were analyzed separately for sites north and south of Point Conception. OSP salmon data and MRFSS non-salmon data were combined for the northern site analysis while only MRFSS data were used for the southern sites. The base years of these data were 1999-2002. It should be noted that during this period, various temporal and area closures were enacted in the rockfish fishery south of Cape Mendocino during 2000, 2001, and 2002. In addition, California recreational salmon landings during 1999 and 2001 were among the lowest observed during the last two decades due to a northern shift in the distribution of chinook salmon. Thus these data may underestimate the monthly catch of various species, including groundfish and salmon, on a site by site basis.

Results revealed that the northern and southern sites had a much higher dependence on salmon and HMS, respectively (Table 1). The two areas also had different impacts on overfished rockfish; for example, bocaccio and cowcod were primarily harvested in the south, while canary and yelloweye rockfish were landed predominantly in the north. These data also showed that less than half of these sites accounted for most of the catch. In southern California, 92% of the catch of management species was landed at 12 of the 37 sites (32%) while in northern California, 91% of the catch of management species occurred at 25 of the 50 sites (50%).

These results suggest that within a survey area, the sites could be split into two-tiered sampling - primary and secondary. The primary sites would be sampled similar to the current OSP methodology (see attachment B) at a 20% level for both the collection of effort (anglers/boats) and species-specific catch rates. The secondary sites would be clustered and sampled at a 3-6%

level per month with only angler catch rate data collected, combined with a roving census on randomly selected days to count empty boat trailers.

Site Stratification of PR Sites by Month

Catch by site and month was analyzed to examine temporal changes in catch at each site. This analysis showed that fisheries in the Crescent City/Eureka Survey Area, Fort Bragg Survey Area, and San Francisco Survey Area take place primarily during May-October (when recreational salmon fishing is at its peak), while the fisheries in the Monterey/Morro Bay Survey Area and Southern California Survey Area occur virtually year round (Table 2).

Sites in each survey area were then ranked by total catch of management species to determine primary and secondary sampling status. From this analysis, some sites were identified as primary sites year-round while others (in fact, most) sites were identified as primary sites only during particular months; however this may be due to recent area and temporal closures in California's rockfish and salmon fisheries. On a few occasions, a site was tagged as a primary site for only one month of the year. This was either due to its borderline rank among all sites for catch of management species or because of a lack of historical data during part of the year. In these cases, the stratification was examined and appropriate smoothing applied to outliers in the historical data. A normal distribution was observed for a number of sites with primary site selection occurring during the summer months.

These results indicate that, under the two-tiered sampling framework, a site would be sampled a uniform number of days for those months when it were designated as primary and sampled relative to the total effort observed within its respective sub-area for those months when it was designated as secondary.

Analysis of Sample Size for Sites and Sample Rate for Boats

A model was set up to analyze the effect of sample size on the standard errors of PR public access estimates of effort and catch. This analysis indicated that between 8-14 days would need to be sampled at each primary sample site each month (25-45% sampling level) to achieve a PSE of 20 for the more common rockfish species and chinook salmon. For less common species, at least one-half of the days in a month would have to be sampled to achieve a PSE near 20 which at present is not within our budget to achieve.

For common species such as black rockfish, a PSE of 20 would be reached for estimating both effort and catch when the sampling rate for boats is as follows: with every boat interviewed, about 8 days; with every 2nd boat, about 9 days; with every 3rd boat, 11 days; with every 4th boat, 13 days; and with every 5th boat, about on-half the month.

This analysis only used data from northern California studies. No southern California data were available to include in this analysis. Because of the species diversity in the south, it is expected that an intensive sampling program will also be needed in the south.

Table 1. Estimated average annual PR landings during 1999-2002 of species groups by statistical area (thousands of fish).

	Species Groups					
	Other	Groundfish	Nearshore	Salmon	HMS	*Total*
Northern California						
Crescent City	228	7126	21	1975	0	9350
Eureka	960	7317	951	9168	0	18396
Fort Bragg	326	7587	735	14774	26	23448
San Francisco	12554	14957	6835	23581	988	58915
Monetery	13116	40163	1322	22550	3032	80183
subtotal	27184	77150	9864	72048	4046	190292
Southern California						
Santa Barbara	5099	3350	1823	347	148	10767
Ventura	23490	20229	2906	342	237	47204
Los Angeles	86828	17013	5806	16	576	110239
Orange	37043	5882	2192	0	1497	46614
San Diego	68628	19744	3281	3	13209	104865
subtotal	221088	66218	16008	708	15667	319689
Total	248272	143368	25872	90745	19713	527970

Table 2. Estimated Average Annual PR Landings of Species of Concern during 1999-2002 by Statistical Area, Port, and Month in Thousands of Fish

	Month												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Crescent City													
Crescent City	0	113	124	206	566	943	1765	1385	748	0	925	0	6775
Cresent City Harbor	0	0	0	92	0	856	1380	412	216	0	583	0	3539
Eureka													
Eureka	0	70	137	391	1783	1491	3493	783	1071	265	0	0	9484
Trinidad	0	0	0	227	1249	1372	2648	2363	1079	267	0	0	9205
Fields Landing	0	0	117	0	1056	1323	1723	543	723	0	0	0	5485
King Salmon	0	0	0	0	450	664	720	431	600	0	0	0	2865
North Spit Ramp	0	0	0	0	1716	0	0	118	0	0	0	0	1834
Eureka Marina	0	0	0	0	0	197	243	178	160	135	0	0	913
Samoa Boat Ramp	0	0	0	0	0	0	189	0	0	0	0	0	189
Fort Bragg													
Shelter Cove	0	0	12	92	707	1894	5086	2115	446	4	15	0	10371
Noyo River	0	129	460	408	1179	1402	3091	1612	585	721	212	319	10118
Point Arena	0	0	0	0	342	0	210	524	592	0	0	0	1668
Van Damme	0	0	0	0	662	139	0	0	51	0	0	0	852
Albion	0	0	0	0	0	0	353	283	0	0	213	0	849
Fort Bragg	0	0	0	0	0	0	0	600	187	0	0	0	787
Mendocino	0	0	0	0	0	0	81	0	0	0	0	0	81
South Harbor	0	0	55	0	0	0	0	0	0	0	0	0	55
San Francisco													
Princeton	0	0	135	1027	1815	2571	1534	2162	1857	1621	791	1132	14645
Bodega West	0	289	135	616	1085	1457	4900	1224	1199	530	606	0	12041
Berkeley Marina	0	0	15	50	123	295	588	772	560	489	368	0	3260
Doran	0	0	0	0	78	22	2387	337	213	30	0	0	3067
Richmond	48	0	525	140	200	277	215	381	336	165	107	500	2894
Sausalito	0	0	0	156	76	202	600	448	240	219	255	0	2196
Mission Rock	0	0	1088	595	131	0	93	28	75	58	86	0	2154

Oyster	0	0	59	140	119	65	216	234	209	449	100	530	2121
Grand Street	130	0	0	52	26	170	250	241	250	71	0	0	1190
Miller	0	0	37	0	10	153	196	263	89	22	3	0	773
San Leandro	15	0	0	23	113	86	90	39	44	337	0	0	747
Emeryville	0	0	0	115	127	46	89	0	163	0	0	0	540
Fort Baker	0	0	0	0	0	0	0	392	0	0	0	0	392
Lawson's	0	0	0	0	0	4	100	27	165	0	0	0	296
Rockaway Linda Mar	0	0	0	0	0	0	253	0	0	0	0	0	253
Loch Lomond	0	0	0	5	9	0	30	112	9	0	26	0	191
Coyote	0	0	0	0	58	10	17	5	34	18	45	0	187
Alameda Rock Wall	0	0	0	0	0	73	92	0	0	0	0	0	165
Stillwater Ocean Cove	0	0	0	0	0	0	143	0	0	0	0	0	143
Redwood City	0	0	0	0	0	0	0	0	124	0	16	0	140
Black Point	45	18	32	0	0	0	0	0	0	0	5	0	100
Vallejo	4	5	6	8	7	15	0	0	16	8	0	0	69
Berkeley Shore	0	0	0	0	38	0	0	0	0	0	0	0	38
Monterey													
Santa Cruz Harbor	205	102	4425	2522	1148	1023	1422	1084	751	593	238	457	13970
Moss Landing	502	2739	30	4316	1298	903	1488	716	1005	534	198	0	13729
Coast Guard Pier Ramp	1229	0	863	1845	1935	1551	1137	687	856	1089	16	0	11208
Avila	361	0	0	310	1154	924	1874	1749	1035	789	0	1614	9810
Morro Bay	0	1090	1141	470	1484	490	1180	1215	1058	698	615	0	9441
Santa Cruz Wharf	588	0	31	15	119	847	993	1056	422	236	0	0	4307
Capitola	0	0	73	93	222	707	475	312	389	164	0	0	2435
Monterey Harbor	0	0	17	64	0	540	0	429	542	219	0	0	1811
Montana del Oro	0	0	1299	0	0	0	0	0	0	0	0	0	1299
Cambria	0	0	0	0	0	0	0	416	0	0	0	0	416
Santa Barbara													
Santa Barbara Harbor	0	143	1275	380	767	745	245	185	217	339	727	412	5435
Goleta	0	0	0	0	0	0	209	0	0	0	0	0	209
Gaviota	0	0	0	0	0	0	0	0	0	0	25	0	25
Ventura													
Channel Islands	569	268	349	395	1042	1287	1518	1860	1505	1846	631	1475	12745

Ventura Harbor	672	1752	2001	502	315	0	421	4293	164	266	424	158	10968
Los Angeles													
Marina Del Rey	682	96	1331	1820	440	712	1058	1314	649	559	561	523	9745
Cabrillo	1335	733	457	633	732	755	195	596	336	655	736	616	7779
Dave's Launch Ramp	215	226	416	425	499	501	309	572	501	551	355	234	4804
Catalina	0	0	0	0	0	0	51	0	526	0	0	0	577
Zuma	0	0	0	0	0	0	0	500	0	0	0	0	500
King Harbor	0	0	0	7	0	0	0	0	0	0	0	0	7
Orange													
Sunset Aquatic Park	495	16	309	218	278	255	443	334	220	97	607	165	3437
Dana Pt.	68	527	32	139	117	248	355	233	443	328	251	409	3150
Newport	48	17	62	55	18	90	694	20	101	1478	0	0	2583
Davey's Locker	0	0	0	18	61	174	82	31	27	0	5	0	398
San Diego													
Shelter Island	205	571	526	1237	1069	2426	2063	1870	3279	1693	884	595	16418
Mission Bay West	253	464	285	392	1170	912	597	885	1000	704	854	618	8134
Oceanside	1740	26	399	38	294	448	398	207	493	95	140	193	4471
Mission Bay East	0	0	128	152	56	295	475	475	0	1313	543	553	3990
Coronado Ferry	58	0	51	0	0	0	776	0	216	51	0	0	1152
Campland Marina	0	0	0	0	578	0	0	0	0	0	0	0	578
J Street	12	0	0	0	0	0	0	0	326	0	116	0	454
Seaforth Sportfishing	0	0	0	0	0	118	0	0	31	279	0	0	428
H & M Landing	0	0	0	0	0	180	0	0	0	0	0	0	180
Coronado Boat Rentals	0	0	0	0	0	0	63	0	0	45	0	0	108
Quivira Basin	0	0	105	0	0	0	0	0	0	0	0	0	105
Agua Hedionda Lagoon	0	0	91	0	0	0	0	0	0	0	0	0	91
Dana Landing Rentals	0	0	0	72	0	0	0	0	0	0	0	0	72
De Anza Cove Launch Ramp	0	0	0	0	0	58	0	0	0	0	0	0	58

Attachment E - Optimizing Sampling Procedures

Optimization of sampling of CPUE over the existing survey will improve data collection efforts.

Canceling and Early Termination of Assignments

Scheduled sampling may be cancelled or terminated if it can be determined the no effort in the assigned area and mode is taking place on the date of the assignment. For on-site effort purposes, this would count as a zero trip day and be included in the expansions for unsampled days.

Increased Roving

Sampling for catch at secondary PR sites and at BB may be expanded to include alternate sites in the same mode of fishing. Roving to additional access sites would be restricted to sites with equivalent levels of effort. Samplers would not rove to primary PR sites or gravitate to high effort secondary sites.
During roving (for any mode), the sampler may also evaluate the operational status of CPFVs.

Weighting of Sites

Sampling secondary PR sites and all other mode sites will be assigned based on the proportion of effort among all sites and not down-weighted for assigned low use sites or up-weighted for high effort sites. Increased roving will help prevent wasteful sampling effort at low use sites while increased rate of sampling (removal of a cap on the number of sampled units) will alleviate the need to up-weight high use sites.

Stratified Effort Levels for Sites

Ranking of sites with equivalent levels of effort for increased roving will prevent gravitation of sampling to high use sites within a fishing mode and area. Samplers will be provided a list of potential lower-use sites that may be sampled as a cluster.

Removing the Cap on the Number of Interviews

Simplified forms will allow more rapid data collection at PR sites and potentially in other modes so that fewer anglers will be missed during sampling at high use sites. Allowing the sampling to proceed at as high a rate as possible at all times and switching to an every Nth angler regime only when actually necessary will increase sampling productivity. Tracking of missed anglers between each interview will allow for potential adjustments to the data for every Nth sampling during high use periods.

Subsampling of Data Elements

The procedure for PR interviewing allows for brief interviewing of some vessels for catch at higher taxonomic levels. Key data has been identified that should be collected for all observable vessels, e.g., collection of tagged fish species information and basic counts of effort and catch. The procedure allows for changing of a complete interview to a subsample of the key data for each boat while maintaining a near census for basic catch data and tagged species. Samplers would return to complete interviews as soon as the number of vessels is manageable. Catch at higher taxonomic levels may be estimated to

the species level based on the composition of species data collected in the complete interviews. Similar prioritizing of the data elements may be applied to the other modes to reduce the number of completely missed samples.

Changing the Sample Unit

Sampling for PR fishing is changed from the angler to the boat sample unit. Data on specific anglers in support of the RDD (residence, etc.) will be subsampled at random from the anglers on the boat. This relieves the need to identify catch to particular anglers on each boat. The number of anglers on each boat is a key item for all interviews for expression of catch rate data at the angler level. Future economic surveys would be supported through subsampling of anglers.

Reduction of the Number of Data Elements

Reduction in the number of angler questions was identified as a means of collecting more observations of catch rate and biological data at high use PR sites. A number of data elements collected in the existing programs were evaluated for PR sampling and found to be unimportant in achieving the goals of the new program. Some of the data elements dropped were not specific to PR sampling or to the boat unit of effort. Since a separate form was being developed for PR sampling, the omission of those data elements would have no impact and simplify the coding form.

The data elements that have been used for PR data analysis or to support data quality procedures and are not included in the new program include detailed information on residence type and residential telephone possession, frequency of angler trips in the past (avidity used to estimate participation), gender, angler name and phone number, fish sex, weight and fate of fish not available for examination by the sampler.

Attachment F. Potential Biases in the California Recreational Fisheries Survey

M e m o r a n d u m

Date: June 19, 2003

To: Debbie Aseltine-Neilson, MRD San Diego

From: **Department of Fish and Game** Calvin Chun, HCD
E-mail: cchun@ dfg.ca.gov

Subject: **Potential Biases in the California Integrated Recreational Fisheries Survey**

We are discussing potential sources of bias in the proposed California Integrated Recreational Fisheries Survey. This discussion does not imply that any or all of these are present in the current program. However, these sources may contribute to bias problems in any new survey. We also are distinguishing between bias and precision. These are separate, but somewhat related issues. The following discussion is restricted to the issue of bias, a systematic deviation from the true population value. A systematic deviation (bias) occurs when the estimates are consistently higher or consistently lower than their respective population values. This list is not intended to be exhaustive. The subtle, lurking biases are often the most important but least conspicuous.

1. **Commercial Passenger Fishing Vessel (CPFV) refusals**

   In the past, being able to get a random sample of boats was not possible since captains were able to refuse samplers. This situation will now likely improve since captains are now "mandated" to allow samplers on the boat. However, the working environment on these "unfriendly" boats may discourage some samplers from riding on these boats, which is a source of bias. This emphasizes the need for education of samplers and a change in attitude between fishers and regulating agencies so that there is better cooperation.

2. **Charter refusals**

   When a CPFV is chartered, the charter master or the landing often refuses access, thinking that charters are exempt from the regulation requiring cooperation. It is important to sample charters because the catch may differ from open party trips. A group of seasoned anglers on an open CPFV may catch a lot of fish, whereas a chartered boat composed of construction workers from San Bernardino may not catch much. Conversely, a group of experienced anglers on a charter may have a higher catch-per-unit-effort (CPUE) than an open party trip. Also, on charter trips some skippers may be more likely to overlook code violations, such as overlimits of fish. This will requite a strong remediation effort, since the entire boat is purchased for the trip, and the charter skipper may not want a sampler onboard.

3. **Angler refusals**

The survey is voluntary and is subject to the Privacy Act, which allows anglers to not participate. Some anglers feel that the survey is an invasion of their privacy. Others are unhappy with fisheries management and refuse to participate in the survey. If anglers who refuse to participate are significantly different from anglers who cooperate, this will introduce a bias.

On CPFV's some operators encourage their regular passengers to not cooperate with the survey. Likewise, anglers on these boats may share the same sentiment as the captain. Note: open expression of such negative attitude is now a violation of the new California law, which forbids interference with observers.

4. **Historically, CPFV crewmembers have not been sampled**

In the past, crew members have not been interviewed, even though they can make up a significant portion of the total catch on a party boat. "Deadheads" often distribute their catch to passengers who were not lucky or skilled enough to catch their own, which will bias angler CPUE. Note: both deadheads and crew are now eligible to be interviewed in the current sampling program. The number of non-paying anglers is included in the CPFV telephone survey in order to match the effort with the CPUE.

5. **Poaching bias**

Anglers who intentionally violate Fish and Game regulations are less likely to cooperate with the survey when they are confronted by someone that they mistakenly think is a game warden. Past experience has shown that anglers go out of their way to avoid talking to a sampler for this reason. It is suspected that the anglers had illegal fish in their possession and thought that they would be cited if found out.

Interaction with wardens by samplers at sampling sites introduces a potential for bias. It reinforces angler perception that the survey is used for enforcement purposes and hence will discourage cooperation from anglers. Such interactions are known to occur, in spite of instructions to minimize contact with wardens.

6. **Language barriers**

At many sites a high percentage of non-English speaking anglers are present. Due to language difficulties the interviews may not reflect what is actually going on. In such situations a suggestion would be to train samplers in the use of a "proxy" interview or an incomplete interview that obtains essential data for estimating catch rates.

7. **Misinterpretation of questions**

The questions asked during the survey were carefully constructed. Samplers are trained to use the wording provided on the questionnaire for response consistency. However, if the questions are not interpreted correctly a bias will occur.

Samplers should be sensitized to the possibility of question misinterpretation and be ready with standardized, alternative wording or explanations for what is expected from the respondent. Wording of questions and explanations should be standardized to eliminate possible bias introduced by poorly or inconsistently worded questions.

8. **Recording errors**

Samplers may code items on the interview forms incorrectly. For example, the common name and code are both required for each species recorded on the coding form. Discrepancies may occur between the name and code entered. Comments on hardcopy facilitate deciphering errors detected later in the data checking. Hard copies can also be readily reviewed by supervisors prior to key entry for logic errors and to provide feedback to samplers.

Note: if notebook or direct data entry methods are adopted, this issue needs to be reexamined. Nonetheless, data checking by supervisor or other personnel at some stage is recommended in preference to self-checking of data by sampler.

9. **Access barriers to marinas and private lands**

Marinas that restrict access to samplers contribute to bias, since the marina anglers may have socio-economic characteristics different from other anglers. For example, private access boats may be larger and target long-range offshore fisheries more often than boats from public access points.

Similarly, samplers cannot access military installations. For example, many Navy personnel in San Diego fish on the U.S. Navy submarine base and at North Island Naval Air Station. These military anglers and their catch may differ from the general angler population.

10. **Dangerous locations that are not sampled**

Some locations in urban areas are believed to be hazardous to samplers. These locations are not included in the sampling frame. Moreover, they may have anglers and their catch that are different from those at safer or more populous sites.

11. **Late afternoon and nighttime fishing are not sampled**

Since sampling generally does not begin very early in the morning nor continue after the late afternoon, we will have incomplete information on day anglers who complete their trips outside of sampling hours. Anglers who complete all their fishing at night are also missed. These anglers may have different characteristics and catch from other anglers.

12. **Non-representative or unusual trips/Hawthorne effect**

Many CPFV operators have stated that they alter their "game plan" when a sampler is onboard. For example, one operator in northern California gave the sampler access to all of his trips, except his "lingcod specials". Others say that

they will avoid areas that they normally fish, so that the sampler will not observe any species of concern being caught.

This behavior is known to social scientists as the Hawthorne effect. Humans have been known to alter their behavior when aware of being observed. Data from such trips may introduce a bias, since trips without samplers may have different fishing behavior. The presence of samplers may induce better compliance with regulations, which leads to a lower catch rate bias.

As a result of increasing restrictions on CPFV owners, operators are inventing new marketing ploys to attract customers. For example, the "Qualifier 105", out of Fisherman's Landing in San Diego, normally operates as a long range sportfisher taking anglers on multiday trips into Mexican waters. However, during March and April, 2003 the Q105 acted as a "mothership" for private skiffs fishing around San Clemente and Santa Catalina Islands. Recently, the CPFV "Great Escape" acted as a mothership for kayak anglers fishing around San Clemente. At present we have no means of including these anglers in our surveys. If these unusual trip types gain popularity, we will need a method to capture these trips in our surveys.

13. **Party Charter Phone Survey refusals**

Although CPFV's are required by law to cooperate with samplers making at-sea observations, they are not required to participate in the Party Charter Phone Survey (PCPS), which is used to estimate effort for the party charter boat mode. Certain sectors of the CPFV fishery and operators in certain regions of the state are more likely to refuse participation, which may introduce a bias in the effort estimates.

14. **Tournaments are not sampled, but pre-tournament data are included**

Tournaments are excluded from sampling, since they are not representative of typical fishing experience. However, for many tournaments anglers "pre-fish" the tournament weeks in advance. An example is the San Diego (SD) Bay Bass tournament run by SD Anglers. During these times the practicing tournament anglers make up a significant portion of interviews at certain sampling sites. The pre-tournament data are included, but not the tournaments themselves. It would be advisable to include a sampling of all recreational trips, including trips during tournaments if they can be sampled with a sufficient number of trips.

15. **Avidity bias**

Avidity bias, the overrepresentation of avid anglers in the sample, can be a serious issue. Since avid anglers may take more boat trips than the less avid anglers, they are overrepresented in the survey data. In addition, less avid anglers may have characteristics that distinguish them from the general population of anglers. For example, they may more frequently carry one-day licenses. Less avid anglers may not bother to purchase a license, which will cause problems with a license-based phone survey system. Anglers fishing without licenses may fish

at locations and hours that differ significantly from other anglers, when it may not be cost effective to have samplers present.

Hence, the less avid angler may not be fully represented in the estimates. For example, in a phone survey based on phone numbers gathered from anglers intercepted in the field, less avid anglers contribute less to the data for effort estimation than the avid anglers. Let A=the event that an angler fished during the survey cycle or wave (one- or two-month period); let B=the event that this angler is called by phone for an effort interview; let C=the event that this angler consents to be interviewed by phone. Let D=ABC, that is, the event that this angler is represented in the phone data for that wave. For a less avid angler, it is likely that the probability of event A, P(A), and the probability of event B, P(B), are lower than for an avid angler. Hence, the probability that a less avid angler is included in the data for that wave, P(D)=P(A)P(B)P(C), will be smaller than for an avid angler. The synergistic, multiplicative effect for P(D) is to be noted.

Effort estimates from telephone surveys using a frame produced by randomly selecting anglers from field interviews will be biased toward an overestimate, since avid anglers will be overrepresented in the sampling frame. This avidity bias will be accentuated if the wave is reduced from a two-month cycle to a one-month cycle, since P(A) will be even smaller for the less avid angler in a shorter wave. However, an off-site random digit dialing (RDD) survey is not subject to the avidity bias; it may be used to produce correction factors for an avidity-biased survey.

16. **Busy CPFV trip**

If the CPFV is busy, say with more than 20 anglers, the total catch of the boat trip may be incomplete. The sampler may not always see what is thrown back, especially when a lot of activity is going on. Also, some anglers may be too busy to be cooperative. Any survey that is dependent on a census of a particular sampling unit, such as an entire boat or site-day, will be negatively biased in counts of anglers and catch. Surveys, such as the current survey, which is based on random sampling of angler trips rather than boats or site-days, will need a sufficient number of anglers randomly selected for sampling.

17. **Incomplete Sampling Frame**

When the sampling frame is incomplete, the potential for bias is present. Kenneth Pollock discusses this bias issue on page 69 of Pollock et al. (1994) Angler Survey Methods. This issue will arise if we adopt the one-in-twenty license sampling frame for the phone effort survey. Recognizing that cost and time constraints force us to temporarily use the one-in-twenty sampling frame, a long range objective of a complete license frame, as implemented by Washington and Oregon, is desirable.

The sampling of license holders from the tear-off mail/telephone survey will require knowledge of the sampling frame, which is all licensed anglers. The trip rate estimated from the angler telephone responses is expanded to the entire population of license holders. An additional adjustment should be made for those that fished without licenses. The number of license holders needs to be accurate

to prevent a negative bias. For example, if the first license in the book of 20 is the one mailed in for the phone survey, we will not know when the other 19 licenses in the book will be sold. So, it will be important that a timely accounting of all licenses sold during specific time periods be made using a method independent of the tear-off count.

For a survey that is dependent on a direct expansion of sampled days to both sampled and unsampled days, it is important to sample days randomly and independently of conditions such as weather and sea state. For example, it would be improper to sample only good weather days, and then expand the estimates to bad weather days.

The current method for producing estimates of angler effort from an off-site telephone survey only relies on a random sample of angler trips. However, it would be expected that the CPUE data would be composed mostly of trips with favorable weather conditions, which may induce a bias in the CPUE estimate.

Problems Mainly for Dock Sampling

18. **Under/over reporting of catch**

Many avid anglers and CPFV operators are aware of the concerns that fishery managers have for certain stocks, like bocaccio. Some will under/over report the numbers of these species taken, attempting to manipulate the numbers available to fishery managers. Thus, it is important that observers monitor the catch rates rather than depend on angler-reported data. However, this is difficult for dock sampling, which is dependent on the accuracy of angler responses.

For dock sampling, not measuring the same fish twice when the boat is full is difficult. Trading of fish occurs between anglers, so it is easy to lose track of what has or has not been measured. Samplers should be trained to measure fish retained on the boats after both fishing and passing of fish are completed or mark measured fish that potentially my be seen again. Nonetheless, fish passing may alter individual CPUE.

19. **Six-Pack Charter Boats sampling may not be truly random**

Because of their small size, samplers are unable to make at-sea observations on six-pack charter boats. Supervisors attempt to compensate for this by assigning dockside sampling of these boats. However, we may not get a truly random sample of such boats. These CPFV's generally run on ad hoc schedules, and often return from trips at times and places not accessible to a sampler.

20. **Boat limits introducing bias**

If boat limits (vs. individual angler limits) were to go into effect, we would not have accurate CPUE data for individual anglers. Estimates could only be made at the boat level. We would have no way of apportioning the boat catch to individual anglers. High grading and passing of fish from more successful anglers to less successful anglers mask actual catch per angler.

Also, as the catch on the boat reaches the limits per angler, the catch becomes more uniform among anglers due to passing of fish. This reduces the variance for angler CPUE, which can be a concern if the CPUE variance is needed for a bag limit analysis.

21. **Memory recall and honesty bias**

The survey samples private boat trips at the docks when fishing is ended. After fishing, anglers are asked about any catch that is not available for inspection. The numbers and species reported caught are subject to memory recall and honesty. This may bias estimates of bycatch if it is systematically under-reported or over-reported. Bycatch will be an increasingly "hot" issue.

22. **Non-gamefish bias**

Anglers can accurately recall their catch for desirable sport species, such as yellowtail. However, when it comes to "non-gamefish", such as mackerel, lizardfish, or even rockfish, the numbers start to get fuzzy and there is potential for bias.

23. **Unaccounted-for rockfish**

When a CPFV catches smaller-sized rockfish species (e.g., half-banded, honeycomb, and squarespotted) these fish are frequently used as bait to catch larger fish. Many times these fish are left in the bait tank when the boat gets back to the dock, unclaimed by any angler. These fish often do not show up in the survey data. Samplers should be trained to recognize the "boat fish" situation and accurately track discards and fish used for bait. Fish that have already been reported as discarded or used for bait should not be double counted. Double counting or omissions are potential sources for bias in the catch rate.

24. **Misidentification bias**

Many anglers are unable to identify their catch. Anglers have a mild tendency to report fish caught using either slang names or incorrect common names. Samplers should be trained to probe for fish descriptions in lieu of slang names, so that actual species could be determined if possible. However, a sampler should never code to a taxonomic level that is not justified by the angler's level of knowledge; rather, samplers should code to an appropriate higher taxonomic level when necessary.

25. **Prestige bias**

Anglers might fictitiously report higher catch for more desirable species to gain the admiration of the sampler or other anglers.

26. **Digit bias**

Anglers tend to report numbers rounded to the nearest even number, or in multiples of five or ten. Also, samplers themselves may have tendencies for digit bias when recording lengths and weights. Samplers should be made aware of this potential bias.

27. **Lies**

Anglers have been encountered who obviously lie. Samplers should be trained to recognize this and code appropriately to avoid obvious lies being recorded as actual data.

Appendix*:*

I have received a number of suggestions for improving the sampling procedure from field samplers and others, which I found extremely valuable. These suggestions should be implemented through appropriate supervisors, such as Michelle Horezcko, Gail Roper, and Russ Porter.

However, I would like to address two suggestions presented as solutions to the bias problem: (1) stratifying, and (2) increasing the sample size. Unfortunately, doing these in and of themselves will not necessarily reduce bias. If you know the mechanism of the bias and if stratification will alleviate it, then by all means do it. However, blindly stratifying in the hopes that it will reduce bias without knowing the mechanism of the bias is unhelpful and costly. Similarly, increasing sample size by itself will not address many bias issues. An increased sample size is effective in increasing precision, but that is not equivalent to reducing bias. Precision and bias are separate but related issues. The diagrams on page 25 of Pollock et al. Angler Survey Methods illustrate the difference.

Acknowledgments:

I express my deep appreciation for all who have sent comments, which contributed to this bias document. Initially I was planning to list every contributor, but decided that I may inadvertently miss someone. However, I would like to single out Ed Roberts and Wade VanBuskirk for their contributions. Their comments formed the framework and much of the text for this memo. My kudos goes to them. Additionally, I would like to thank Tom Barnes for initially raising the bias issue. Until he spoke up about this, I wasn't aware of the possible existence of bias in the sampling. Without everyone's help, including those not specifically mentioned by name, this document would have been meager indeed.

References: Pollock, K. H., C. M. Jones, and T. L. Brown. 1994. Angler Survey Methods and their Applications in Fisheries Management. American Fisheries Society Special Publication 25.